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**SOVIET BLOC INTERNATIONAL  
GEOPHYSICAL YEAR INFORMATION  
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SOVIET BLOC INTERNATIONAL GEOPHYSICAL YEAR INFORMATION

February 21, 1958

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This report presents unevaluated information on Soviet Bloc International Geophysical Year activities selected from foreign-language publications as indicated in parentheses. It is published as an aid to United States Government research.

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I. GENERAL

Soviets Continue to Popularize the IGY for the Masses

Mezhdunarodnyy Geofizicheskiy God (International Geophysical Year) by V. P. Tsesevich, published by Gostekhizdat, was to have been released during the fourth quarter of 1957, according to an announcement in a soviet book catalogue. The purpose of the book, as stated in the announcement, is to present in simple, readable form to a wide audience of readers the problems facing scientists during the IGY and how they will be solved. (Sovetskiye Knigi, No 163, 1957, p 32)

Polish Participation in IGY Program

An abstract of a Polish article describes measures undertaken by the IGY Committee under the Polish Academy of Sciences for the organization of the investigations which must be conducted by the Poles. The basic problems which will be studied during the IGY are listed. The Commission on Astronomy, Geodesy, and Gravity will investigate changes of geographical latitude and longitude associated with the shifting of the poles and irregularities of the earth's rotation. The Meteorological Commission will study the over-all circulation of the atmosphere and the energy balance system of the earth-atmosphere, and will conduct radiosonde measurements of the temperature, pressure, and moisture content of the air, and of the wind up to 30 kilometers. This commission will conduct oceanographic investigations of the dynamic processes in the Bay of Danzig and in the southern part of the Baltic Sea. The commission's studies on magnetism, atmospheric electricity, and the ionosphere will include variations of the Earth's magnetic field and the electromagnetic phenomena in the Earth's atmosphere.

In the field of seismology, the Commission on Seismology will be interested chiefly in the study of earthquakes in Poland and adjacent territories.

The investigation of solar activity is of major importance to the Heliophysics Commission. A subcommission on the organization of Polish expeditions was formed. A map showing the arrangement of the network of Polish geophysical stations was given. (Problemy, Issue 12, No 7, 1956, pp 479-480 [from Referativnyy Zhurnal -- Geofizika, No 3, Mar 57, Abstract No 1629, by I. N. Leonardova])

## II. ROCKETS AND ARTIFICIAL EARTH SATELLITES

### Soviets Distribute Preliminary Report on Sputnik I

According to a 22 January 1958 press item, a preliminary scientific report on launching of satellites had been prepared and was being sent to IGY organizations in accordance with the obligations assumed by the Soviet Committee for the Conduct of the IGY.

The press item observed that on 4 January Sputnik I had ceased existence and in 3 months had made approximately 1,400 revolutions around the Earth and had traveled 60 million kilometers.

As told to a Tass correspondent by the Soviet Committee for the Conduct of the IGY, the calculations of Soviet scientists on the lifetime of the satellite were completely confirmed. Careful observations of the flight, the use of methods developed by Soviet mathematicians and of the high-speed electronic computer made it possible to accurately predict the ephemeris of the satellite at any given moment.

Observations made during the flight of Sputnik I made it possible to collect valuable scientific material on the density of the upper layers of the atmosphere, the structure of the ionosphere, and other geophysical phenomena. Signals of the satellite on the 15-meter band were received at a very great distance exceeding, by far, the range of direct visibility and in a number of cases reached a distance to 10,000 kilometers. Investigations of the satellite signals revealed that in certain layers of the ionosphere peculiar waveguides facilitating radiowave propagation to great distances were formed.

It was established that meteor danger was in reality less than previously supposed. The satellite passed through meteor showers and, in spite of this, survived without injury over a long period of time. The temperature conditions which a satellite is subjected to were revealed. The first results of observations of the flight of Sputnik I made it possible to make the parameters and orbit of Sputnik II more precise.

The Soviet IGY Committee took measures to provide complete information to scientists and a wide circles of people of all countries on the most important features of the experiment conducted with Sputnik I.

Before the launching of the satellite, numerous articles, in which methods of investigations used in the flight of the satellite and the appropriate instruments were described in detail, appeared in scientific journals. In radio amateur journals data describing radio receiving devices for reception of satellite signals were given in advance. Instructions on optical observations were given in astronomical publications.

The problems involved in launching a satellite were discussed in the Soviet popular and scientific press. This made it possible to organize observations of the satellite throughout the country.

Much assistance in the collection of data on Sputnik's flight were given by observation stations and radio amateurs of many countries. Many hundreds of letters and telegrams with reports on observations conducted were received by the Soviet IGY Committee. Valuable information was presented by scientists of Czechoslovakia, China, Poland, East Germany, and other People's Democracies.

Observatories and stations in Ireland, England, and some Latin American countries reported their observations.

The press item concludes with the observation that only casual reports were received from the US, where there are a great number of observation stations. (Moscow, Izvestiya, 22 Jan 58)

#### Soviet Film on Sputniks I and II

A short newspaper notice indicates that Moscow cinematographers have made a documentary entitled "First Soviet Earth Satellites." The film is directed by M. Slavinskaya and N. Chigorin and is based on a script by A. Sazonov. The first part of the movie acquaints one with the history of the mastery of the Cosmos by science. (Moscow, Izvestiya, 19 Dec 57)

#### Soviets Translate and Publish Brochure of US Satellite Articles

A. Buyanov, an engineer, has reviewed a Soviet brochure of translated US articles on the artificial earth satellite. The 75-page brochure, entitled Iskusstvennyy sputnik Zemli (Artificial Earth Satellite), was published by the "Sovetskoye Radio" Publishing House in 1957 and sells for 2 rubles 25 kopecks. Titles of the individual articles are given, but the authors are not identified: the review says only that these articles were papers read by US scientists before an audience of 2,000 radio engineers. Yu. S. Khlebtsevich edited the brochure, which the reviewer says is of great interest for the Soviet reader. (Tekhnika-Molodezhi, No 9, Sep 57, pp 38-39)

China Sets Up 12 Satellite Observation Stations

Under the sponsorship of the Academia Sinica Sciences, according to a Peiping newspaper, 12 observation stations for the tracking of the Soviet earth satellite are now being established in various areas throughout China, including Peiping, Nanking, Lan-chou, K'un-ming, Lhasa, Wuhan, Ch'ang-ch'un, Canton, Sian, Urumchi, Tientsin, and Shanghai. A total of 120 wide-field (12 degrees) telescopes for use in the observation stations will be supplied by the USSR. Radio sets capable of receiving signals at frequencies of 20-40 megacycles are now being installed in the various stations. (Peiping, Kuang-ming Jih-pao, 4 Nov 57)

III. UPPER ATMOSPHERE

First Results of Radar Observations of Meteor Activity Reported

G. A. Nasyrov of the Institute of Physics and Geophysics of the Academy of Sciences Turkmen SSR submitted a report on 7 December 1957 on radar determinations of meteor activity from July to September 1957 in Ashkhabad which indicates that a total of 1,760 reflections were recorded during this period. Nasyrov's report follows

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In connection with the beginning of the IGY, the Astrophysics Laboratory of the Institute of Physics and Geophysics of the Academy of Sciences Turkmen SSR began the systematic registration of meteor activity according to the IGY program on a 4.2-meter wave length. The antenna used is a wave duct and is permanently directed toward the west. Maximum power is 80 kilowatts at a frequency of 50 pulses per second. The receive-transmit antenna consists of seven elements inclined at a 22.5 degree angle to the horizontal plane and located at a height of two wave lengths (at a height of three wave lengths until 18 July 1957). The station is equipped with automatic control, an automatic calibrator, and a separate photographing device, which records meteor radio echoes and their duplication, thus ensuring their reliable selection from among the usual disturbances. Recording is made on a movie film by which slant range scanning is fixed through every 50 kilometers to distances of 350 kilometers and time markers are placed on the movie film simultaneously. In addition, another instrument, the "artificial meteor," makes it possible for the operator to calibrate the duration of the reflection each time. The photographing device and the "artificial meteor" were made at Khar'kov Polytechnic Institute under the supervision of B. L. Kashcheyev. RF-3 film was used. The station is organized under the general direction of I. S. Astapovich, and A. T. Belous, Yu. L. Truttse, A. Kh. Khanberdyev, Yu. Rodin, O. Ovezgel'dyyev, M. I. Kalyakina, Yu. N. Inozemtsev, and G. A. Nasyrov took part in the work.

The processed negatives showed that for 630 hours and 13 minutes of observations, 1,760 reflections ("radio meteors") were recorded. Of these, 247 were obtained from 1 to 17 July 1957 at an antenna height of 3 wave lengths and 1,513 were obtained thereafter at an antenna height of 2 wave lengths. The average hourly number by the month, beginning at 0001-0100 Z and each hour thereafter to 2300-2400 Z, are given as follows (numbers in parentheses indicate data from insufficient number of hours of operation):

July --2.0, 3.0, 3.6, 3.2, 3.6, 4.0, 3.9, 2.4, 0.8, 1.0, 2.1, 1.7, 2.9, 2.7, 3.0, 2.8, 2.4, 2.0, 1.7, 4.0, 2.2, 2.7, 1.4, 2.1; average = 2.49, n = 445.

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August -- 7.6, 4.1, 4.9, 3.2, 4.0, 4.1, 5.5, 4.3, 3.7, 4.7, 3.4, 3.0, 5.3, 5.0, 4.9, 4.5, 3.9, 3.8, 3.6, 6.0, 5.8, 4.5, 2.8, 6.2; average = 4.44, n = 843.

September -- 2.1, 1.1, 2.0, 1.8, 2.0, 2.1, 1.9, 1.6, (2.9), (5.5), (2.0), 2.0, (1.3), 1.0, (2.3), (1.7), 0.8, 1.6, 2.1, 1.7, 1.6, 1.0, 2.2, 1.8; average = 1.84, n = 252.

The greatest number of meteors were observed in August. A more detailed analysis of data shows that the maximum occurred during 10-15 August 1957, which can be attributed to the Perseids. The diurnal variation curve shows a minimum at about 1400 local solar time and a maximum in the morning and evening hours.

Distribution according to slant range is given as follows:

<u>Range (kilometers)</u>	<u>No of Radio Meters</u>
60	4
60-90	46
90-120	85
120-150	154
150-180	312
180-210	228
210-240	227
240-270	173
270-300	138
300-330	108
330	44
Total	1,519

Within the 55- to 100-kilometers range the mode drops to an altitude of 85-90 kilometers. Taking as an average  $H = 87$ , we find that the angle of inclination  $i$  of the antenna corresponds with the maximum of the slant range  $r = H \operatorname{cosec} i = 87 \times 2.61 = 227$  kilometers.

A total of 1,433 (94.6%) of the radio reflections were of less than one second duration, 66 (4.4%) of approximately one second duration, and 15 (1.0%) of considerably more than one second duration. (Izvestiya Akademii Nauk Turkmenskoy SSR, No 6, Nov-Dec 57, p 100)

#### New Soviet Astronomical Equipment Includes Use of TV Telescope

A TV telescope capable of magnifying the diameter of the lunar disk to 6 meters is among the astronomical equipment designed and in use at the Main Astronomical Observatory at Pulkovo during the IGY. An ordinary telescope with a focal length of 20 meters which can be increased to 50 and even 100 meters by changing one of the mirrors in the optical system is used in conjunction with a TV camera. In addition to the increased magnification achieved by modifying the optical system, the electrical system also makes it possible to magnify the image even more.

This new combination of telescope and TV camera makes it possible to obtain distinct pictures of stars, planets, comets, nebulae and to sharply increase their luminosity on a TV screen. Astronomers have already taken several tens of photographs of the Moon, and several double stars of the eighth and ninth magnitude have been photographed. Mars will be photographed during the time of its regular opposition this year in an attempt to solve the age-old argument on the existence of so-called Martian canals.

The TV telescope, which was designed by N. F. Kuprevich, a senior scientific associate at the observatory, is temporarily set up on a balcony of the main building of the observatory. A special pavilion will soon be constructed for it.

A special pavilion has already been constructed on Pulkovo heights for another also entirely original instrument, the Leningrad Zenith Telescope (ZTL-180). This telescope has an objective lens diameter of 180 millimeters and a focal length of 2,360 millimeters. It is the largest telescope of its kind in the world and is being used in the study of the movement of the Earth's poles during the IGY.

The ZTL-180 was constructed in Leningrad according to the technical specifications developed by V. I. Sakharov and I. F. Korbut, scientific associates of the observatory. To protect the telescope from the heat of summer, the pavilion in which the telescope is located is insulated. The inside is covered with a cork layer and the outside is painted with an aluminum paint which reflects solar radiation.

O. Karyshev, who describes the TV and zenith telescopes in a newspaper article, also points out that cameras are used for recording the results of observations and that such instruments now are set up at Moscow, Kitab, Irkutsk, and other stations in the USSR. (Leningradskaya Pravda, 8 Jan 58)

IV. METEOROLOGY

Meteorological Stations in China CPYRGHT

China has some 1,000 meteorological observatories and stations distributed in the various areas throughout the nation. This number is more than 20 times that of the preliberation period. (Shih-chia-chuang Jih-pao, 6 Sep 57)

CPYRGHT

V. OCEANOGRAPHY

Vityaz' Plumbs Pacific Depths CPYRGHT

N. Pavlov, first mate for political affairs aboard the Soviet expeditionary ship Vityaz' of the Institute of Oceanology of the Academy of Sciences USSR, reports on the progress of its voyage in the Pacific. In a radiogram he reports that the ship has traveled thousands of miles, during which valuable scientific discoveries were made and parts of the IGY program were successfully fulfilled. At the time of the report, the ship was completing its trip from New Zealand to the Tonga Islands.

The Tonga depression, little studied heretofore, was explored in December. Geological, biological, and other investigations were conducted here. Interesting soil samples were obtained at depths of 8 kilometers. Using a self-recording instrument, a record depth of 10,800 kilometers was registered here.

Cameras were used in photographing the ocean bottom at great depths. A camera of new design by Zenkevich was used. At a depth of 10,000 meters the camera automatically recorded the bottom topography. (Leningradskaya Pravda, 3, 16 Jan 58)

CPYRGHT

First Chinese Oceanographic Research Ship Launched

China's first oceanographic research ship, the SS Chin-sheng (Golden Star), was to leave the Shanghai Chung-hua Shipyard on 6 June 1957 and go to Tsing-tao, according to a Shanghai newspaper.

The vessel, a converted ocean-going tug, has a displacement of 1,500 tons and can travel at a speed of 13 nautical miles an hour. There are six research laboratories on the vessel. On arrival at Tsingtao, the vessel was to be equipped with various types of research instruments by the Marine Biological Research Unit of the Academia Sinica in the Tsingtao area. The ship was then to start its scientific expedition. (Shanghai, Hsin-wen Jih-pao, 7 Jun 57, p 1)

The Hsin-hua News Agency reported that the SS Chin-sheng would conduct its scientific expedition in China's territorial waters under the direction of the marine biological laboratory in Tsingtao and that it would investigate the physical and biological conditions of the ocean and collect data on marine resources. (Peiping, Hsin-hua News Agency release, 7 Jun 57)

#### Soviet Oceanographic Research Team in Tsingtao

A Chinese newspaper reported on 28 December 1957 that the Soviet oceanographic ship Pao-shih (Gem) and medium-sized trawler No 4347 carrying a Soviet oceanographic research team including a total of 49 members headed by Vishinskiy, chief of the Laboratory of Surface Layer Fish, Pacific Ocean Scientific Research Institute of the Fishing Economy and Oceanography of the USSR, arrived in Tsingtao the previous week. Accompanying the team was Kim Tok-kyong, chief of the Western Sea Marine Production Institute, North Korea.

According to the paper, the team will cooperate with the Chinese scientists in making a scientific study of the marine biology, ocean physics, and marine chemistry of both the Yellow Sea and the East China Sea. The paper added that the present oceanographic expedition is based on an agreement signed between China, the USSR, North Korea, and North Vietnam during a conference concerning technical cooperation in connection with the work of fishery, oceanography, and limnology in the western Pacific area in 1956 and proposals of a 21-point technical cooperation agreement reached during the second conference in Moscow in August 1957.

Also among the famous USSR scientists in the team were Kaganovskaya, chief of the Laboratory of Bottom Layer Fish, Pacific Ocean Scientific Research Institute of the Fishing Economy and Oceanography of the USSR, and Biryulin, chief of the Laboratory of Oceanography and Hydrology of the same institute. (Peiping, Kuang-ming Jih-pao, 28 Dec 57)

## VI. LATITUDE

### Soviets Aid Chinese in Setting Up Latitude Station

Some time ago a group of Soviet scientists headed by A. A. Mikhaylov, Corresponding Member of the Academy of Sciences USSR, visited China, where they assisted Chinese astronomers in selecting Tientsin as a site for making latitude observations. Later, a zenith telescope was sent to Tientsin from Leningrad.

Chao I-sing, a Chinese professor, and his assistants then visited Pulkovo, where the Main Astronomical Observatory of the Academy of Sciences USSR is located, and acquainted themselves with the methods of making latitude observations. (Leningradskaya Pravda, 8 Jan 58)

## VII. SEISMOLOGY

### Lhasa Observatory Uses Chinese-Made Equipment

A Lhasa newspaper article titled "On the Work of the Lhasa Observatory," by Hsi Ping-chih and Chou Chin-p'ing, gives the following information.

All recording apparatuses used in the Lhasa observatory are of Chinese make. They have all been manufactured in the Chinese plants since the liberation. To register the shocks and motions of earthquakes, the Model-51 seismograph, designed and produced by Li Shan-pang, a seismologist and a research fellow of the Geophysics Research Institute of the Academia Sinica, is now being used. The Kirnos seismograph, copied after a Soviet model by the Chinese last year, is also being used. The performance of the latter is considered to be very satisfactory; it gives accurate recordings of earthquakes in all directions. To study geomagnetism, two sets of recording equipment (one for recording at normal speed and the other at higher speed) were installed in the observatory. These are Chinese-made, but are copies of Danish geomagnetic recording equipment.

In the past, there were no systematic and scientific materials on geomagnetism and seismology available in Tibet. Some 20 years ago, however, geomagnetic survey work was done in the areas of Lhasa, Zhi-katse, and Ya-tung by a German. His study lacked materials concerning periodic geomagnetic changes of the areas. Therefore, the distribution, changes, and characteristics of geomagnetism in the Tibetan plateau were not made known. With the establishment of the Lhasa observatory, it is expected that more information along this line will soon be made known to the world. (Lhasa, Tibet Jih-pao, 14 Aug 57)

VIII. GLACIOLOGY

Soviet Preparations for IGY Investigations in Suntar-Khayata Mountain Range

CPYRGHT

The following is a complete translation of the article, "Preparation for Investigations in the Suntar-Khayata Mountain Region," by N. A. Grave:

The study of areas of cooling in the Earth's sphere (the cryosphere) in the polar and high-mountain regions enters in the IGY program of scientific investigations.

Glaciers, frozen ground, and rocks are basic objectives in the study of the cryosphere. The occurrence and development of these formations depend on the special features of certain geophysical processes which are jointly dependent on the transfer of heat between the Earth's crust, atmosphere, and lithosphere. Investigations of both the cryosphere phenomena and their specific processes, conducted periodically and simultaneously in various sections of the Earth's sphere and under various physicogeographical and geological conditions, will make it possible to explain not only the direction and intensity of changes in separate elements of the cryosphere according to time and area, but also to establish the reasons for these changes.

In accordance with a decision by the Presidium of the Academy of Sciences USSR, a glaciological and geocryological (permafrost) station is being organized in the high-mountain region of Yakutsk by the Northeast Branch of the Institute of Frost Studies imeni V. A. Obruchev, Academy of Sciences USSR. In connection with this, a reconnaissance expedition of the Academy of Sciences USSR had visited the Suntar-Khayata Mountain Range in 1956. The investigations proposed for this region are of great scientific interest. A high-mountain meteorological station has already been constructed in this region by the Kolyma Administration of the Hydrometeorological Service USSR.

The Suntar-Khayata Mountain Range attracted the attention of scientists by its unique combination of physicogeographical and geological conditions. The geographical contrasts and abundance of cryospheric phenomena and formations concentrated in a comparatively small area give this mountain region a special natural appearance.

The Suntar-Khayata Mountain Range, appearing as a southern spur of the Verkhoyansk Mountains, represents an independent mountain group forming the watershed for the Indigirka and Aldan basins and the rivers which flow into the Sea of Okhotsk. It consists of sharply defined Alpine-type mountains extending in a 150-kilometer belt from the northwest to the southeast with a width reaching 50 kilometer. Absolute heights of the mountain range reach 2,500 to 2,800 meters and the highest point in the northern section of the range has an altitude of 2,959 meters.

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This range is the orographical dividing line for air masses of Pacific Ocean and continental origin. Along with the Buordakhskiy Mountains located further north, the Suntar-Khayata Mountain Range is the sole region of significant contemporary glaciation in the central-continental portion of northeast Asia.

Around these centers of glaciation, at the sources of rivers flowing down the mountain range and at an altitude of about 1,300 meters, are located thick multiyear ice layers (ice fields) which are associated with the emergence of subterranean waters. The surfaces of the river benches and morainic strata are covered with a dense network of frost clefts. The location of the glaciers and ice fields and also a sketch of the mountain range orthography is given in Figure 1 [not reproduced here].

The Suntar-Khayata Mountain Range is located 150 kilometer from the Oymyakonsk Plateau in whose depressions have been registered the lowest air temperatures in the northern hemisphere.

The entire region has a well defined altitude-zoning of vegetative cover, soils, and climate. Thus, the wooded sections of depressions in the Oymyakonsk Plateau, which are located at an altitude of about 600 to 700 meters, changes into a taiga which reaches the foot of the high peaks and changes into a mountain tundra at an elevation of about 1,300 meters. The climate is milder in the high-mountain regions than in the depressions of the plateau.

The Suntar-Khayata Mountain Range has been little investigated. All the large expeditions directed towards the northeast, from Yakutsk in the basins of Kolyma, and beginning with the expedition of Sarychev (1876) and ending with the expeditions of S. Obruchev (1926-1929), were conducted at the edge of the high-mountain region. The first data on glaciers in the northeast portion of the mountain range was obtained by the geologist Lezhoyev. He gave the dimensions of the glaciers and the altitude of the snow line in this section of the mountains. The most detailed presentation on glaciers of the Suntar-Khayata Mountain Range was obtained through the works of the geographer L. L. Berman (Voprosy geografii [Problems of Geography], No 4, 1947).

In 1946, aerial photographic survey materials of the northern and central portions of the mountain range were studied, 13 glaciers were explored and a catalogue was compiled containing 114 glaciers and snow fields. According to the calculations of Yu. N. Popov conducted in 1948, the total area of glaciation in the Suntar-Khayata area consisted of 160 square kilometers. This made it possible to consider this range as the largest region of contemporary glaciation in northeast Asia, next to the Koryakskiy Mountain Range and the Buordakskiy Mountains.

Such substantial glaciation in the Suntar-Khayata region under sharp continental climate conditions (winters with little snow and comparative warm summer seasons) presents to a certain degree a geographical paradox. Up to this time the conditions for the existence of glaciers in Suntar-Khayata have not been conclusively explained. Having investigated the glaciers and ice fields in the central section of the mountain range, at the headwaters of the Kongor River, P. F. Shvetsov expressed an assumption on the interrelation of these two phenomena.

The purpose of the investigations in the Suntar-Khayata Mountain Range region during the IGY is to explain the principles and peculiarities in the existence of glaciers, ice fields, frozen soils, and mountain rocks; and also their composition, dynamics, and relationship to various physico-geographical and geological conditions characteristic for the border regions of northeast USSR.

Glaciological and geocryological investigations in the region of the Suntar-Kayata Mountain Range will be conducted in four directions: (1) the study of heat exchange in mountain rocks, soils, glaciers, ice fields, and snow fields; (2) the study of the physico-geographical and geological conditions determining the characteristics of heat exchange; (3) the study of glaciers, ice fields, frozen soils, and mountain rocks; and (4) the study of cryogenic (frozen) forms of relief.

All processes and phenomena related to the first of the above-mentioned themes will be studied under four different sets of conditions: (a) in conditions of mountain-fold formations in the high-mountain strip at elevations greater than 2,000 meters; (b) in those of glacier regions; (c) on ice fields, in mountain valleys in the foothills of the mountain range at an altitude from 1,000 to 1,500 meters and (d) in hollows of the plateau at an altitude of 650 meters in the region of the so-called "pole of cold."

The most detailed and complete investigations are planned to be conducted from the high-mountain station area in the Suntar-Khayata Mountain Range and near the Tomtor meteorological station in the Oymyakonsk depression. At these points the glaciological station will conduct systematic geothermic measurements through borings not less than 30 meters in depth and also observations of snow deposits, freezing and thawing of soils, evaporation and condensation and moisture transfer in soils and mountain rocks. External factors of heat exchange (radiant, thermic, etc.) are being investigated by meteorological stations of the Magadan and Yakutsk Administrations of the Hydrometeorological Service USSR.

Preparations are being made for temperature investigations of one of the glaciers and its bed rocks. Surface studies on this glacier will be made on radiation balance, thickness and properties of the snow, processes in the condensation and vaporization of moisture, the temperature and humidity of the air and the wind velocity. Similar observations will be conducted periodically on one of the ice fields of the Burgali River Valley.

Basic observations will be conducted by remote-control electrical metering devices.

The conditions of heat exchange are to be studied in regions of the Suntar-Khayata Mountain Range and in the Oymyakonsk depression. Local relief, its geological structure, vegetation, soils, etc., will also be subjected to investigation.

A basic problem in the study of glaciers and ice fields in the establishment of the principles and character of ice formation in various glaciological zones, explanation of the contemporary condition of glaciation, its history and also the connection with the frozen zone of the lithosphere. In this program great attention will be given to problems concerning the morphology and structure of glaciers, ice fields, and other forms of surface and subterranean ice and the substantial balance and movement of ice in glaciers.

Systematic investigations of the morphology, genesis, and development of mounds, polygonal formations, thermal karsts, and solifluctions will enter into the study of cryogenic forms of relief.

Other specialists beside the co-workers of the station, in particular botanists and soil scientists, will participate in fulfilling this program. A detachment of the Institute of Geography of the Academy of Sciences USSR will study ancient glaciation.

The decision was made to build a glaciological station in the northern section of the Suntar-Khayata Mountain Range along with the meteorological station of the Kolyma Administration of Hydrometeorological Services.

The general area of both stations is suitable for meteorological observations and temperature measurements of mountain rocks. It is located in a region with typical glacial landscape at an elevation of 2,040 meters in a mountain saddle which forms a continuous glacial valley at the upper reaches of the Burgali River, one of the tributaries of the Indigirka.

The problems of building construction and transportation of construction and other materials to the construction area confronted the collective of the stations in the very beginning of planning.

Using the example of the meteorologists, it was decided to build a log building from the local larch woods located 40 to 50 kilometers below in the Burgali River valley. The building will be hot water heated. The transportation problem proved more complex.

Although transport of material is easily accomplished by airlines from Yakutsk to Oymyakon, even ordinary means of communication from Oymyakon to the region in which the station is located (150 kilometer in a straight line to the southwest of the airdrome) do not exist.

The experience of building the meteorological station showed that transport of freight from Oymyakon by deer and horses along unbeaten taiga and mountain paths is very costly and requires a great amount of time. Because of this, it was decided to transport people and freight by air from Oymyakon. For this purpose it became necessary to select a spot in the construction area which would be suitable for landing aircraft. Materials must be delivered to the station itself by deer.

A flight was made into the mountain range region on 24 August for the purpose of aerial reconnaissance. Participants in the flight were P. F. Shvetsov, Corresponding Member of the Academy of Sciences USSR and director of the Institute of Frost Studies of the Academy of Sciences USSR; P. I. Mel'nikov, chief of the northeast branch of the institute; A. B. Bogomolov, associate of the station; and the author of this article as director of the future station.

It was shown through familiarization with the locality by air that the area on which construction of the station was contemplated is located in the immediate vicinity of glaciers and ice fields. A small lake was discovered in the area. Among the lifeless rocky mountains appeared tents and the meteorological station under construction. However, it was not possible to find a landing spot during this flight and the sharply interlaced relief of the mountains did not permit the aircraft to descend lower than 800 meters above the valley floor. In the first attempt to fly down the glacial trough of the Burgali valley there was danger of being pressed against one of the rocky slopes of the valley by gusts of wind rushing into the glacial trough from side canyons. A test landing was accomplished on 1 September, 25 kilometers from the future station on the first bench of the Bengali River near two large ice fields.

After spending several days in improvement of the "airdrome," all of the workers of the station and about 13 tons of freight consisting of tents, warm clothing, instruments, gasoline, kerosene, a field power plant and a 7-month supply of provisions were brought in. The station staff consists of 15 co-workers. Thus, the temporary camp was raised in the valley of the Burgali River.

Two considerably large glaciers are located at a distance of 3 to 5 kilometers from the station. Their length exceeded 4 kilometers and a thickness 100 meters. The lower edge of the glaciers is covered by accumulations of moraine, the stratum of which together with the underlying original base rock is cut through by deep ravines with vertical walls 20 to 30 meters high. Along the bottom of the ravines flow little streams which

appear from beneath the glaciers and are lost in the gravel and rock wastes of the floor. Moraines were preserved only on the high benches of the valley. The valley floor and the first bench are built up of alluvium which consists of coarse and poorly rolled gravel and boulders. The second bench, which is at present covered with ancient moraine, was formed back in the glacier age. The beautifully formed glacial trough in the upper reaches of the Burgali River Valley extends from the end of the glacier for approximately 15 kilometers and at a distance of 20 to 30 kilometers it meets well preserved moraines.

The surrounding mountains and station area are built up of argillite which consists of hornstone sandstone of the Permian or Triassic ages, crumpled into folds and broken through by dikes of granodiorite-porphyrific rock. The valley is filled in with a relatively thin layer of coarse material.

Two ice fields were investigated below the station area and not far from the temporary camp. These fields do not melt during summer and were thus preserved through the course of many years. The first field has an area of about 50,000 square meters and an average thickness of about 1.6 meters.

The second ice field, the upper end of which is located in a barren depression on a mountain slope, has a strongly elongated form and a length of 5 kilometers. Its greatest thickness reaches 5 meters at the end of September.

The clearing of woods for construction of the station and build-up of fire-wood was begun 15 October, 15 kilometers below the temporary camp. Toward December the framework for the building was completed but its transfer to the building site by deer was delayed due to the thin cover of snow in the mountains. Borings were begun at the same time by the meteorological station in Tomtor. Toward spring the framework was transferred to the mountains.

The cool but clear and dry September weather favored the journey of the expedition. However, winter set in the region of the station in mid-September, snow fell, and everything was enveloped in dense clouds of fog.

During winter, in January and February, the air temperature at the station level falls to minus 55 and minus 60 degrees centigrade. Nevertheless, the collective of winterers did not curtail preparatory operations for conducting investigations in the IGY program. This made it possible to complete construction of the station on time and begin observations in the IGY program on schedule, i.e., 1 July 1957. (Mezhdunarodnyy Geofizicheskiy God, No 3, 1957, pp 68-73)

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## IX. GEOMAGNETISM

### History of the Organization of Magnetic Observatories in the USSR

A history of the organization of the network of magnetic observatories in the USSR during the 40 years of Soviet rule up to 1957 and the principal results of their works are briefly covered in an article by Yu. D. Kalinin of the Scientific Research Institute of Terrestrial Magnetism, Ionosphere, and Radiowave Propagation.

The period is considered according to the following divisions: Magnetic Observatories in Russia Before the Revolution; Network of Magnetic Observatories, 1917-1930; Network of Magnetic Observatories, 1931-1940; Network of Magnetic Observatories, 1941-1957; Principal Works Accomplished in the Magnetic Observatories; and Magnetic Variation Stations (Temporary and Expeditionary). Of these, the last three have the greatest interest.

The invasion of the German armies during World War II interrupted the work of some observatories and resulted in the destruction of the buildings and installations of others. Among these were the Pavlov and the Odessa magnetic observatories. The remainder did not discontinue their observations even in the most difficult times. In fact, the Main Administration for the Northern Sea Route organized still another new magnetic observatory on the Bukhta Tiksi, which began regular operations in 1944. After the war, urgent measures were taken toward the establishment of magnetic observatories. Since the Leningrad observatory in Pavlovsk suffered the destruction of its building and installations it was decided to rebuild it at Sel'tso, and it was renamed Voyeykovo, in 1949. This observatory began regular observations at temporary quarters in December 1946. A magnetic observatory was organized near Moscow in Krasnaya Pakhra, replacing the one which was destroyed at Nizhnedevitsk. This observatory began regular operations in temporary quarters in 1946, transferring to a new permanent pavilion in 1957.

The Scientific Research Institute of Terrestrial Magnetism began the organization of its own branch in Murmansk after the war. Observations were renewed in Stepanovka (near Odessa) in 1948. The L'vov Magnetic Observatory was rebuilt in 1949-1952, and went into operation in 1953. The Vladivostok Magnetic Observatory was moved from May-Tun to Voroshilov, where it renewed its work in 1952. Also, work at the observatory in Yuzhno-Sakhalinsk was resumed in 1948.

In connection with the Soviet Union's participation in the IGY programs, preliminary work on the organization of additional new magnetic observatories, in Tomsk (University), Ashkhabad (Academy of Sciences Turkmen SSR), and Kiev (Academy of Sciences Ukrainian SSR), was accomplished in 1956 and 1957.

Thus, toward mid- 1957 there were 19 observatories in operation in the USSR: 6 under the supervision of the Main Administration of the Northern Sea Route, 10 under the Ministry of Communications USSR, 2 under the Ministry of Higher Education, and one under the Academy of Sciences Georgian SSR. In addition, five more observatories will begin conducting regular observations very soon. These are located at Mys Vykhodnoy (instead of Matochkina Shar), Murmansk, Tomsk, Kiev, and Ashkhabad.

Among the principal works completed in the magnetic observatories, the following are mentioned. A number of studies on the state of the equipment being used in the observatories were made from 1917 to 1957. This equipment was composed in part of instruments manufactured in the last half of the 19th and the beginning of the 20th centuries. Among them were first-class magnetic theodolites (in the Leningrad, Irkutsk, Tbilisi, Odessa, and Sverdlovsk observatories) and certain series of magnetic variometers and induction inclinometers. The studies, which were confined to a comparison of the absolute readings of the instruments of the different observatories, confirmed the high quality of the equipment. Engaged in this work were M. S. Penkevich, F. F. Ilgach, and P. Ye. Fedulov. A magnetic theodolite, designed by B. B. Golitsyn and made in Germany, which has been stored for a long time without being used in the Pavlovsk Magnetic Observatory, was, after a detailed study which recommended certain alterations, placed into operation during the postwar years. Its accuracy in the measurement of the horizontal component is  $\pm 1.10^{-5}$  oersteds.

The effect of moisture on magnetic variometer readings was studied by V. N. Bobrov. A number of designs of magnetic variometers in which the magnet is suspended by quartz tension members was developed by V. F. Shel'ting. In addition, some magnetic variometers of new design and some magnetic variation stations (by B. Ye. Bryuneli and B. M. Yanovskiy) and magnetic theodolites (by K. G. Bronshteyn, V. A. Ul'yanin, L. S. Banukhin, and N. N. Trubyatchinskiy) were built.

The results of magnetic observations have not been fully published. Certain materials from certain observatories were published in publications of the Main Geophysical Observatory and the Arctic Institute. After 1940, however, such materials as hourly average values of magnetic components were not published. Only certain generalized results of observations, such as daily variations, were published. The generalized data of the observations of almost all the observatories of the USSR as a whole during 1938-1948 were presented in Spravochnike Po Peremennomu Magnitnomu Polyu SSSR (Handbook on the Variable Magnetic Field of the USSR), edited by V. I. Afanas'yeva and published in 1954.

Since 1937, data on magnetic activity have been systematically published in a number of publications. A number of studies were devoted to the problems of procedures of magnetic observatories (M. S. Penkevich, V. I. Afanas'yeva, and S. M. Kozik). Among them are annual reviews of magnetic activity, catalogues of magnetic storms, and works devoted to statistics of magnetic activity. A number of works were devoted to the morphology of solar-diurnal magnetic variations (N. I. Ben'kova and V. N. Mikhalkov), the morphology of secular geomagnetic variations according to the data of magnetic observatories, and problems of the theory of magnetic variometers.

Observations of the shifting of the Earth's magnetic field with the aid of magnetic variometers were made by temporary and expeditionary stations in addition to the permanent magnetic observatories. Among them must be mentioned the drift stations which since 1937 have been systematically organized on the ice of the central polar basin by the Main Administration of the Northern Sea Route. Seven such stations were organized up to 1957, each of which worked many months as it was carried along by the Arctic ice.

In the north Asiatic part of the USSR, the experiment of organizing in a season groups of variation stations which provide material for forming an opinion on local magnetic variations, was accomplished. A certain number of temporary variation stations were created for shorter periods (in connection with the study of the geomagnetic effects of the solar eclipses of 1936 and 1952, the study of magnetic anomalies, etc.).

In 1956 magnetic observatories were organized in the Antarctic at Mirnyy and other locations.

The network of Soviet magnetic observatories has greatly increased since 1917 and continues to expand today. The Scientific Research Institute of Terrestrial Magnetism established in 1940 is a complex institute today, in which the supervision of almost all permanent magnetic observatories is centered. An original method for the critical analysis of observational data from magnetic observatories, the basis of which is the comparison of variations in the readings taken by them, was developed, and a similar method does not exist in any other country.

In the last few years there has been a tendency to create new types of magnetometric apparatus, the introduction of which will very soon eliminate the present expensive observatory buildings. (Izvestiya Akademii Nauk SSSR, Seriya Geofizicheskaya, No 12, Dec 57, pp 1469-1477)